Annotated references on insect light traps

Dean Pentcheff
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Here are a few notes extracted from (what appears to be most of) the published literature on insect light attraction relevant to trapping.

Allan, S. A., J. F. Day, and J. D. Edman. 1987. Visual ecology of biting flies. Annual Review of Entomology 32:297–314.

- Culicidae: 5x more activity on full moon.
- Simuliidae, Tabanidae: mostly daylight.
- Muscidae: strong 360 nm (UV) and 450–550 nm (blue-green) attraction.

Bishop, A. L., R. Worrall, L. J. Spohr, H. J. McKenzie, and I. M. Barchia. 2004. Response of *Culicoides* spp. (Diptera: Ceratopogonidae) to light-emitting diodes. Australian Journal of Entomology 43:184–188.

- LEDs (3–5) powered by 3 1.5 V D cells: blue, green, white, red, yellow (no UV).
- Output measured with LI-COR KI-250 Light Meter (quantum sensor).
- Green (520 nm) wins.

Briscoe, A. D., and L. Chittka. 2001. The evolution of color vision in insects. Annual Review of Entomology 46:471–510.

- Limited variability in spectral properties of receptors. Pretty much: UV, blue, green, and red.

Burkett, D. A., and J. F. Butler. 2005. Laboratory evaluation of colored light as an attractant for female *Aedes aegypti*, *Aedes albopictus*, *Anopheles quadrimaculatus*, and *Culex nigripalpus*. Florida Entomologist 88:383–389.

- Mostly blue/green and white preference.

Cohnstaedt, L. W., J. I. Gillen, and L. E. Munstermann. 2008. Light-emitting diode technology improves insect trapping. Journal of the American Mosquito Control Association 24:331–334.

- Design of a 4–8 LED 6V (4 D cell) lights for a fan-trap.
- Pictures of the design (patented — see patent document for details)

Cohnstaedt, L. W., K. Rochon, A. J. Duehl, J. F. Anderson, R. Barrera, N.-Y. Su, A. C. Gerry, P. J. Obenauer, J. F. Campbell, T. J. Lysyk, and S. A. Allan. 2012. Arthropod surveillance programs: basic components, strategies, and analysis. Annals of the Entomological Society of America 105:135–149.

- Urban light traps have to compete with urban light pollution.

Cohnstaedt, W. M., L. W. Cohnstaedt, and J. I. Gillen. 2010, August 31. Methods and compositions for improved light traps.

- Large capture traps could use 10–25 LEDs.
- Plurality of wavelengths in one trap, specifics are species-dependent.
- Polygonal PCBs with LEDs at the edges, multiple platforms can be combined.
- Circuit consists of LED(s), resistor(s), & Zener diode (protect LEDs from reverse current).

Cowan, T., and G. Gries. 2009. Ultraviolet and violet light: attractive orientation cues for the Indian meal moth, *Plodia interpunctella*. Entomologia Experimentalis et Applicata 131:148–158.

- Unclear what the stimulus was: single LED? (lab enclosure study)
- Violet (405 nm) plus UV wins over UV (350 nm).

Cruz, M. S., and R. Lindner. 2011. Insect vision: ultraviolet, color, and LED light. Cree, Inc. http://www.cree.com/~/media/Files/Cree/Lighting/Misc%20Tech%20Docs/InsectVision_UVColorandLEDLight.pdf

- Company summary of some insect light-attraction literature.
- UV, green, and blue work often.
- Polarized light can matter to some (e.g. dung beetles).

Duehl, A. J., L. W. Cohnstaedt, R. T. Arbogast, and P. E. A. Teal. 2011. Evaluating light attraction to increase trap efficiency for *Tribolium castaneum* (Coleoptera: Tenebrionidae). Journal of Economic Entomology 104:1430–1435.

- Crawling insects, lab enclosure.
- UV (390 nm) wins.

Epsky, N. D., W. L. Morrill, and Mankin, R. 2004. Traps for capturing insects. Pages 2318–2329 *in* J. L. Capinera, editor. Encyclopedia of entomology. . Kluwer Academic Publishers, Norwell, MA.

- On water-pan traps: note that the soap should have no odorants (we must supply soap!).
- Notes mercury and UV lights for moths; incandescent for flies & mosquitoes, green for beetles.
- Light trap designs often include funnels or baffles.

IPM Thailand. (n.d.). Soap. http://thailand.ipm-info.org/components/soap.htm.

- Liquid soaps (e.g. liquid detergent) at 0.5 – 0.8% should work, and is safe.

Oboyski, P. T. (n.d.). Insect collecting — Oboyski. http://nature.berkeley.edu/~oboyski67/download/collecting.htm

- Picture of a bucket-type UV light trap.

Russo, L., R. Stehouwer, J. M. Heberling, and K. Shea. 2011. The composite insect trap: an innovative combination trap for biologically diverse sampling. PLoS ONE 6:e21079.

- Modified Malaise trap + pan trap (with no comparison experiment) = PLoS ONE publication.

Semeao, A. A., J. F. Campbell, R. J. Whitworth, and P. E. Sloderbeck. 2011. Response of *Tribolium castaneum* and *Tribolium confusum* adults to vertical black shapes and its potential to improve trap capture. Journal of Stored Products Research 47:88–94.

- Dark vertical bars increase capture of these beetles: may be irrelevant to nighttime light traps.

Southwood, T. R. E., and P. A. Henderson. 2009. Ecological methods. . John Wiley & Sons.

- Comments on efficacy of light traps at sampling insect diversity (via Google snippet view).